

Study on Novel Reburning Process for NO_x Reduction by Oscillating Injection of Reburn Fuel

Authors : Changyeop Lee, Sewon Kim, Jongho Lee

Abstract : Reburning technology has been developed to adopt various commercial combustion systems. Fuel lean reburning is an advanced reburning method to reduce NO_x economically without using burnout air, however it is not easy to get high NO_x reduction efficiency. In the fuel lean reburning system, the localized fuel rich eddies are used to establish partial fuel rich regions so that the NO_x can react with hydrocarbon radical restrictively. In this paper, a new advanced reburning method which supplies reburn fuel with oscillatory motion is introduced to increase NO_x reduction rate effectively. To clarify whether forced oscillating injection of reburn fuel can effectively reduce NO_x emission, experimental tests were conducted in vertical combustion furnace. Experiments were performed in flames stabilized by a gas burner, which was mounted at the bottom of the furnace. The natural gas is used as both main and reburn fuel and total thermal input is about 40kW. The forced oscillating injection of reburn fuel is realized by electronic solenoid valve, so that fuel rich region and fuel lean region is established alternately. In the fuel rich region, NO_x is converted to N₂ by reburning reaction, however unburned hydrocarbon and CO is oxidized in fuel lean zone and mixing zone at downstream where slightly fuel lean region is formed by mixing of two regions. This paper reports data on flue gas emissions and temperature distribution in the furnace for a wide range of experimental conditions. All experimental data has been measured at steady state. The NO_x reduction rate increases up to 41% by forced oscillating reburn motion. The CO emissions were shown to be kept at very low level. And this paper makes clear that in order to decrease NO_x concentration in the exhaust when oscillating reburn fuel injection system is adopted, the control of factors such as frequency and duty ratio is very important.

Keywords : NO_x, CO, reburning, pollutant

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020